Quicklook Report:

Coral spawning in the upper Florida Keys, Aug-Sept 2015

PRBD-2015-04

Prepared by: M. W. Miller, NMFS/SEFSC

Contributing observers:

D. Williams, R. Pausch, A. Bright (SEFSC Benthic Ecosystem Assessment and Research team)

L. MacLaughlin (NOAA/National Marine Sanctuaries Program)

X. Serrano (NOAA/Atlantic Oceanographic and Meteorological Laboratory)

J. Fisch, P. Kushlan, R. Winter, C. Drury, E. Towle (Univ of Miami, RSMAS/MBE)

C. Page (Mote Marine Lab)

Abstract:

Given the substantial warm-water induced bleaching experienced by Florida Keys corals in fall 2014, and substantial heat stress already experienced in June-July 2015, expectations for spawning in 2015 were somewhat low. The dates of the full moon (31 July and 29 August) also raised additional uncertainties for timing of potential spawning. Despite these uncertainties, SEFSC and partners documented at least some *Acropora* spawn in Aug 2015 (3 sites) but none in Sept (only one site observed). Meanwhile, this was the second year that we attempted genet-specific spawning observations for *Orbicella faveolata*. Although two sites were genotyped in 2014, observations were possible only at Horseshoe Reef (3 nights each in Aug and Sept). The genotyped population at Horseshoe is only slightly clonal; approximately 35 colonies comprising 28 genets were observed. Approximately 19 of these genets spawned at least some in August. In September, four of these genets spawned again (mostly on 5 Sept), along with one additional genet that had not spawned in August. Hence, eight of the 28 observed *O. faveolata* genets did not spawn.

Background:

The SEFSC Benthic Ecosystem Assessment and Research team has been undertaking genet-specific spawning observations of *Acropora palmata* populations in the upper Keys since 2003 during the 'expected' spawning window (nights 2-6 after the full moon in Aug, 22:00-23:00). This observational record, though not perfect, may represent one of the longest observational records for *A. palmata* spawning in existence, during which 'good' spawning years for *A. palmata* had been documented in 2006, 2009, 2013, and 2014 (with very poor years in between).

A. cervicornis has had a much patchier distribution during this historical period and had not been the focus of spawning observations in the upper Keys until 2009, when contributing partners (CRF and the Aquanauts group) observed spawning by outplanted *A. cervicornis* (cultured at the CRF field nursery) at Molasses reef. The field distribution of *A. cervicornis* populations makes it logistically infeasible to systematically observe spawning by wild populations in the Florida Keys. Meanwhile, increasing efforts based at the CRF nursery (and land-based) have been carried out by the Florida Aquarium and collaborating aquarium and research partners. Overall, similar patterns in timing and extent of spawning have evolved between our *A. palmata* record and the cultured *A. cervicornis* populations. However, extensive 2015 observations of *A. cervicornis* spawning by Fl Aquarium/CRF teams are not reported here.

Montastraea (now *Orbicella*) *faveolata* has historically been much more reliable in spawning during nights 6-8 after the August full moon. Our historic observations are not comprehensive, but we have always observed at least some spawning on at least one of two nights of observation at just one or two Key Largo sites. Based on prior observations of highly variable fertilization success over this period, in June 2014, we invested in mapping and genotyping *Orbicella faveolata* at two sites (Horseshoe and Grecian Rocks) with prior *O. faveolata* spawning observations. This effort revealed a much higher degree of clonality than anticipated for a coral of massive morphology, but the two sites were very different. Grecian Rocks is highly clonal (only 8 distinct genets detected in ~ 50 sampled colonies) whereas Horseshoe is much less so (~40 genets among ~50 colonies sampled). This investment enabled us to begin the construction of genet-specific observational record for *O. faveolata* at these two sites. However, due to logistic constraints, no observations of the *O. faveolata* patch at Grecian Rocks were possible in 2015.

2015 Observations

Spawning observations by site and species are given in the table. Overall, *A. palmata* spawned reasonably well on a single night in August, though several genets were not observed to spawn at all. For *O. faveolata* at Horseshoe reef, we observed approximately 35 colonies each night comprising 28 genets. Multiple genets spawned on several evenings in August, but many showed a low proportion of their total polyps releasing gametes and some genets were not observed to spawn at all.

Due to many un-spawned genets in August, we launched additional effort for the September spawning window. No *Acropora* spp. spawning was observed on the two most likely nights in Sept (nights 4-5 After the Full Moon)[1]. Only one Horseshoe *O. faveolata* colony produced a small dribble of bundles on night 6 AFM and a small proportion of genets spawned mostly small amounts on night 7AFM, only one of which had not spawned at least some in August. Eight of the 28 *O. faveolata* genets under observation (28%) failed to spawn over all 6 nights (both months) of observation. Many of the Horseshoe *O. fav* colonies were at least partially bleached during the September spawning observations, for a second year in a row. It is expected that warm temperature stress and bleaching may compromise reproductive success in future years (Levitan et al. (2014) Long-term reduced spawning in *Orbicella* coral species due to temperature stress. Mar Ecol Prog Ser 515:1-10).

A special opportunistic observation was made by MacLaughlin and Page on 3 Sept at Horseshoe reef of spawning by *Siderastraea siderea*. Both male and female colonies (Fig 1) were observed spawning ~ 11:30 pm. Although this species has been inferred to be a gonochoric broadcast spawner from histological studies, to our knowledge, this is the first direct observation of spawning by this common hermatypic species.

Acknowledgements: Support for these activities was provided by NOAA's Coral Reef Conservation Program, with logistic support from Florida Keys National Marine Sanctuary, Mote Marine Lab, and P.Kushlan. Additional partnership in the 'coral spawning endeavor' by the Florida Aquarium, Univ. of Florida, and the Coral Restoration Foundation are greatly appreciated. The nature of the endeavor means that the cooperation of these many partners makes for a much greater contribution than any of us working separately.

[1] At least one observation of Sept 2015 *A. palmata* spawning elsewhere in the Caribbean was publicly reported from Puerto Rico (Appendix 1)

Table 1. Spawning observations on upper Florida Keys reefs by species and site.

Date (AFM*)	Site	Observing Team	Species	Action
2 Aug (2)	Elbow	SEFSC	*A. palmata*	No spawning signs
3 Aug (3)	Elbow	SEFSC	*A. palmata*	No spawning signs
3 Aug (3)	Horseshoe	SEFSC/ L.MacLaughlin	*A. palmata/ A. cervicornis*	No spawning signs
4 Aug (4)	Elbow	SEFSC	*A. palmata*	2 of 6 genets spawned well, dribbles from a third
4 Aug (4)	Horseshoe	L. MacLaughlin	*A. palmata/ A. cervicornis*	1 of 3 Ap genets spawned well, 2 or 3 Ac colonies spawned^
4 Aug (4)	Sand Island	SEFSC	*A. palmata*	2 of 4 genets spawned
5 Aug (5)	Elbow	SEFSC	*A. palmata*	No spawning signs
5 Aug (5)	Sand Island	SEFSC	*A. palmata*	No spawning signs
6 Aug (6)	Elbow	SEFSC	*A. palmata*	No spawning signs
6 Aug (6)	Sand Island	SEFSC	*A. palmata*	No spawning signs
6 Aug (6)	Horseshoe	RSMAS	*O. faveolata*	20 of 35 colonies observed to spawn, but many released from a small proportion of their polyps
7 Aug (7)	Horseshoe	SEFSC	*O. faveolata*	14 of 35 colonies observed to spawn
8 Aug (8)	Horseshoe	SEFSC	*O. faveolata*	No spawning signs
2 Sept (4)	Elbow	SEFSC	*A. palmata*	No spawning signs
2 Sept (4)	Horseshoe	MacLaughlin/ Page	*A. palmata/ A. cervicornis*	No spawning signs
3 Sept (5)	Elbow	SEFSC	*A. palmata*	No spawning signs
3 Sept (5)	Horseshoe	MacLaughlin/ Page	*O. faveolata*	No spawning signs
3 Sept (5)	Horseshoe	MacLaughlin/ Page	*Siderastrea siderea*	Gonochoric spawning by both male and female colonies observed
4 Sept (6)	Horseshoe	SEFSC	*O. faveolata*	Dribbles from one colony
5 Sept (7)	Horseshoe	SEFSC	*O. faveolata*	6 of 35 colonies spawned

*After Full Moon

^ *A. cervicornis* colonies at Horseshoe reef have not been genotyped so clonal structure is not known. However, gametes were collected from 2 colonies which failed to form viable larvae, suggesting they may have been clones

Figure 1: Eggs being extruded from extended polyps of *Siderastrea siderea* on 3 Sept 2015 at Horseshoe reef. Photo credit: C. Page.

APPENDIX 1: Coral List report by Dr. Edwin Hernandez-Delgado (Univ. Puerto Rico) of *A. palmata* spawning in Puerto Rico 3-4th Sept 2015 when no *A. palmata* spawning was observed (among 6 genets) at Elbow reef.

Message: 6
Date: Sat, 5 Sep 2015 15:33:49 +0000 (UTC)
From: Hernandez Edwin <coral_giac@yahoo.com>
Subject: [Coral-List] Mass spawning in Acropora palmata in Puerto Rico
To: Coral List <coral-list@coral.aoml.noaa.gov>
Message-ID:
<1922751517.1447057.1441467229188.JavaMail.yahoo@mail.yahoo.com>
Content-Type: text/plain; charset=UTF-8

Dear Listers.
Greetings! This short notice is to inform that mass spawning was documented in Elkhorn coral (Acropora palmata) at Vega Baja, along the northern coast of Puerto Rico, during the evenings of Thursday Sept. 3 (21:10-21:30 hr) and Friday Sept. 4 (21:00-21:30 hr). Mass spawning was the most extensive documented since 2008 in the area.

No spawning was documented yet in Staghorn coral (Acropora cervicornis) in Vega Baja. No spawning was documented in A. cervicornis in Culebra Island either (Thursday Sept. 3).

We also have information that mass spawning was also documented in Brain coral (Pseudodiploria strigosa) in Isla Verde, at Carolina, Puerto Rico.
Will provide additional information if necessary.
Edwin A. Hernandez-Delgado, Ph.D.
Affiliate Researcher

University of Puerto Rico
Center for Applied Tropical Ecology and Conservation
Coral Reef Research Group
P.O. Box 23360
San Juan, Puerto Rico 00931-3360